taken to prevent dead space; as fat is slow in forming a solid union, these sutures are left in place for two weeks; stitch marks in these ordinarily unexposed areas being not considered of consequence compared with the more desirable contour gained by the operation.

Recurrence is practically impossible if all the fat, clear down to the fascia, is removed; shock is very minor, in spite of the frequently very extensive resections.

512 Pacific National Building.

DISCUSSION

GEORGE WARREN PIERCE, M. D. (490 Post Street, San Francisco).—Doctor Bames' paper is a timely one. The public today demands this type of surgery from both the social and economic viewpoints. The pseudo-specialist and the advertising charlatan have been quick to offer a dubious service, with the result that this type of surgery has received considerable discredit from too frequent unfortunate results. It is incumbent on the medical profession to meet the demand with properly trained specialists. This type of work calls for exactness of technique and mature judgment. No mistakes can be made, lest they become a lasting monument to inefficiency.

It is interesting to note almost a change of character which often comes to patients after the correction of a facial deformity, such as a deformed nose; increased attention to personal appearance and dress, an infusion of confidence evident in bearing, and a losing of sensitiveness which sometimes amounts to an inferiority complex. It has been my observation that patients are more sensitive of deformities of the nose than of any other feature of the face.

Doctor Bames' outline of technique is of interest. While each surgeon may vary his method, the basic principles must be the same. I find, however, that my results have been better in fresh wounds of the face as occur after automobile accidents, if complete debridement is done as soon as possible and primary suture with small silkworm-gut drains is used.

❋

HOWARD L. UPDEGRAFF, M. D. (6777 Hollywood Boulevard, Hollywood).—I am glad to see that Doctor Bames draws a distinction between reconstructive and esthetic plastic surgery. There is a very definite place for esthetic plastic surgery. Most of the specialties began, so to speak, in most humble manner. It might almost be said that the surgeon of today was the barber of yesteryear; the obstetrician was the midwife; the genito-urinary specialist the venereal disease exponent, who even today advertises in the public comfort stations in England. The radiologist is still within our memory the experimenter of the 1890's, while the physiotherapist is trying to shake himself loose from the pathists who are cashing in on his stock in trade. Oculists were preceded by men who vended spectacles, the neurologists drove out the devils of a disordered mind, and so on with all the specialties until none of us, if we are inclined to be genealogical, but see a professional family tree of which we speak little; that is, if we would go back and point out some of the more unfavorable beginnings.

Doctor Bames, in his paper, has shown courage in advocating "face-shifting" and "contour correction," surgical procedures which have at the hands of inexperienced operators aroused much grief. I have not found metal clips or delayed repair following trauma of advantage. Doctor Bames stressed an important fact in the avoidance of catgut in repair where there is a possibility of infection. Also one of the secrets of nonscarring is the use of compression rather than sutures to control skin hemorrhage.

❋

WILLIAM S. KISKADDEN, M. D. (803 Wilshire Medical Building, Los Angeles).—I desire to endorse what has been brought out both in Doctor Bames' paper and in the discussion, regarding the present status of plastic surgery. Unfortunately the free use of the phrase "plastic surgery" by charlatans and beauty parlors has brought to this new and important specialty an undeserved association with quackery.

Doctor Bames has wisely pointed out the importance of avoiding skin tension. We know that it is certainly one of the most prominent predisposing factors in keloid formation. In the secondary repair of old scars adequate undermining of the skin will often permit closure of large raw areas without tension. If keloid formation is feared or has previously occurred, the use of fractional skin doses of x-ray, with accompanying compensating lapses of time will be found of value. This treatment should, however, be instituted early.

I would like to stress the value of light dressings that allow diffusions of air through them and to the wound. The trauma of operative procedure may frequently irritate skin edges and if a thick dressing is reinforced by adhesive, the tendency for bacterial incubation in a warm, moist medium is greatly enhanced. In harelip surgery, where the baby's hands are restrained, we dispense with all dressings and apply only a thin coating of yellow oxid of mercury.

❋

DOCTOR BAMES (Closing).—The discussion brought out two points:

1. An endorsement of the contention that operations and wound treatment should receive consideration from the esthetic as well as the surgical viewpoint.

2. That there is a difference of opinion on methods of getting results which meet both requirements.

It is evident that an interchange of experiences in this field is decidedly apropos. If this paper succeeds in arousing such action, it will have more than served its purpose.

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# INFECTIONS OF THE ETHMOID LABYRINTH*

*By* FERRIS ARNOLD, M. D.
*Long Beach*

DISCUSSION *by F. H. Linthicum, M. D., Los Angeles; Isaac H. Jones, M. D., Los Angeles.*

SOME of the most interesting problems found in the field of otolaryngology are those associated with pathologic changes of the ethmoid labyrinth. Great diversity of opinion exists as to what constitutes the proper interpretation of the findings and the treatment of those conditions. One must learn to evaluate properly all factors entering in a given case and to keep primarily in mind the thought of what is best for the patient's welfare. With these elements always in mind, needless or harmful treatment will be avoided.

ANATOMY

The ethmoid labyrinth, anatomically considered, is the central point in the nasal accessory

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sinus system. Therefore it is nearly always the site of pathologic processes when other sinus infections are present.

The ethmoid is subject to many anatomical variations. There may be accessory cells in various locations, such as the large cell which is frequently encountered in the tip of the concha media. Another frequent variation is that of a large ethmoidal cell directly in front and above the sphenoid itself. These accessory cells are often infected and failure to exenterate them will cause a persistence of symptoms. The openings of the ethmoid cells into the nose are separated into two groups by the plate of the concha media; the posterior group of ethmoid cells open above and posterior, and the anterior between the concha media and lateral wall of the nose. Secretion appearing in the nares between septum and concha media comes from the posterior group. Secretions appearing between the concha media and lateral wall of nose in middle meatus come from the anterior group.

The outer wall of the ethmoid is formed by the orbital plate and by the mesial wall of the maxillary antrum. This plate is very fragile and easily penetrated.

The brain fossa has an intimate relation with the roof of the ethmoid labyrinth. The bony roof of the ethmoid joins the cribriform plate, but the cells are not in contact with this plate, the bone here being rather heavy. The cribriform plate is the roof of the common meatus. The most dependent portion of the ethmoid labyrinth seen in inspection of the nasal cavity is the bulla ethmoidalis. This appears as a rounded protuberance just under the concha media. The unciform process has an enclosed cell, sometimes quite large, termed the agger nasi. This is to the outer side of the bulla on lateral wall. Occasionally there is a large ethmoid cell just under the frontal sinus. Swelling of this often causes occlusion of the nasofrontal duct simulating a frontal sinusitis.

A thorough knowledge of the regional anatomy is necessary to successful operation upon the ethmoid. One should take into consideration the various anatomic variations of this sinus and look for them while doing the operation.

The ethmoid labyrinth is the embryologic center of development of the sinuses, the others being outgrowths of it. Because of its relation to the other sinuses, consideration must be given to the ethmoid labyrinth as a factor in all sinus infections. More or less involvement of the ethmoid is always present in all sinus infections. Proper treatment and results in sinus infection are in ratio to the consideration of the ethmoid factor. Nasal infections usually have as a primary site the ethmoid labyrinth, and it is also most often the last point of infection to be cleared up. Shambaugh [1] states: "Surgical treatment of inflammatory processes of any or all nasal sinuses includes to a greater or lesser extent operation upon the ethmoid labyrinth."

PATHOLOGY AND SYMPTOMS

Colds. The most prominent etiologic factor in ethmoid infection is the so-called common cold. This is an acute catarrhal infection involving the mucous membranes of the nasal passages. Acute catarrhal ethmoiditis is frequently found as an associated condition. In this the mucous membrane of the ethmoid region becomes edematous and intumescent. There is a profuse serous exudate which causes partial or complete occlusion of the ostia of the ethmoid.

Examination of the region of the middle meatus shows the characteristic swollen appearance of the undersurface of the concha media, unciform process and bulla ethmoidalis. There is considerable mucoid secretion seen in the middle meatus. Small mucous polyps may be seen covering the surface of the mucous membranes of the region.

Influenza. Another type of acute ethmoiditis is that seen during epidemics of influenza. In this type the discharge is more watery and the membranes of the nares have a deeply injected appearance. The conchae are greatly swollen and cause occlusion of the nasal passages. The pain is severe, radiating along the course of the seventh and fifth nerves. Accompanying the process there is often an otitis with reddened tympanic membrane and injected canal walls.[2] There may be temporary visual disturbances due to inflammatory processes around the optic tract.

*Acute Catarrhal Ethmoiditis.*—The symptoms of acute catarrhal ethmoiditis are those which arise because of insufficient drainage and ventilation of the ethmoid cells. There is a feeling of fullness or pain between the eyes. There is a great deal of sneezing, together with a profuse discharge, which at first is thin and watery, but soon becomes thick and tenacious. The symptom of sneezing is characteristic of ethmoid involvement, being due to irritation of the sensitive nerve endings in that region. Due to the intense edema of the structures, breathing through the nose is interfered with. There is profuse lachrymation and swelling around the orbital rim. The history given is that of a persistent cold.

Empyema. At times the condition progresses and the drainage of the region is so interfered with that an empyema of the ethmoid results. The symptoms are those of pressure, the pain in some cases being quite severe. There may be softening of the bony walls around the orbit with production of edema and later a fistula at the canthus.[3] Marked exophthalmos may be present. This condition may simulate that of a cavernous sinus thrombosis.[4] Rarely there is extension backward through the sphenoid ostia and upward through the cribriform plate, producing meningeal symptoms or even brain abscess. Basilar infection may result, causing symptoms similar to an encephalitis.[5] The suggestion is made that there is a possibility of the encephalitis which at times follows influenza having as an associated factor, involvement of the posterior group of sinuses. A recent report by Pfahler [6] attempts to demonstrate by skiagraphs basilar involvement and bony

changes due to chronic posterior group infection. It is entirely within presumption that this may happen in rare instances, but one would hesitate to operate on these cases from the skiagraph findings alone.

Empyema of the ethmoid usually have as sequelae, antrum, and occasionally frontal, infection. The latter is sometimes complicated by closure of the nasofrontal duct by swollen ethmoid cells. Here the symptoms are quite severe, pain with marked edema of eyelids being present.

The empyema may become a chronic condition attended by a more or less continuous purulent nasal and postnasal discharge of offensive odor and acrid character; the postnasal discharge causing in turn a severe pharyngitis and laryngitis or a tracheobronchitis. The history in such cases is that of a profuse discharge upon arising in the morning, accompanied by coughing and expectoration until the night's accumulation has been gotten rid of.

*Chronic Hypertrophic Ethmoiditis.*—The common chronic type of ethmoid involvement is that of chronic hypertrophy. This is a nonsuppurative condition, but may have a secondary infection superimposed. In the hyperplastic type the mucous membranes undergo a polypoid form of degeneration. Later the bony structure itself is the site of absorption and proliferation of new bone. This is cystic, soft, fragile bone. The underlying structure of bone becomes eburnated resembling in structure bone in which arthritic changes have taken place.

The characteristic symptoms of this type are frequent sneezing and profuse watery, acrid, irritating discharge. Frequently a troublesome cough, due to tracheobronchial infection, is present. Complaint is made of a stuffy feeling in the nose or of complete nasal obstruction. Patient may state he has had a persistent cold or catches cold very easily. The mucous membrane of the nose seems to be sensitive to proteins such as flowers and dust. This type of ethmoid infection is often present in hay fever patients. Many cases of hay fever do not have the physical findings of hyperplastic ethmoiditis, but in those cases that do, surgery is of great benefit.

Certain asthmatic conditions have an associated hyperplastic ethmoiditis. It is in these cases that surgery gives its best results. Not all cases of asthma are due to or have hyperplastic ethmoiditis or ethmoid infection of any type. Careful study must be made of each case before determination can be made as to the advisability of ethmoid exenteration. Various protein tests should be made by one who is familiar with the allergic reactions. Careful physical examination should be made by a competent internist. It is believed that only with the closest coöperation between family physician, internist, and rhinologist, can results be had in these cases. There is no one causal factor in the etiology of asthmatic conditions. Treatment should not cease with the operation.

Neuroretinitis. The problem of neuroretinitis is one in which the rhinologist is much interested. Frequently there is an ethmoid infection factor present in these cases, often of the hyperplastic type. Detailed study must be made of these cases to determine whether or not operation will benefit. There is no one diagnostic aid that will help. Of course, in those cases where definite suppurative processes can be found, operation is imperative. Those cases with absence of any suppurative processes present a difficult proposition as to advisability of operation. These cases are those of the hyperplastic type usually. The evidences here of infective processes may be slight, yet the patient may have a definite nerve involvement. The decision in these instances should rest upon the question of the severity of the sinus infection and the degree of the nerve involvement. Where either factor is present in severe degree the case should be operated. In case of mild sinusitis and retinitis expectant treatment is advisable, the case being carefully observed. It is a well-known fact that many neuritic and inflammatory conditions in other parts of the body subside without radical treatment. It is therefore reasonable to expect that the mild cases of optic nerve involvement will recover. All cases of optic neuritis should not be subjected to such a formidable operation as sphenoid and ethmoid exenteration. Those cases of sudden onset, with definite sinus disease, central scotomata and loss of color perception should be operated without delay because here the damage to the nerve may be permanent if operation is delayed. Those cases that present themselves with history of old persistent nasal discharge, gradual color loss and fundus findings of an old process should be gone into carefully and each case decided as a clinical entity. Simply because one patient responds wonderfully to operation is no reason why the next patient should have operation. This is a wholesome thought that recurs as we see patients who have had ill-advised nasal operations performed by those who have not attained a proper appreciation of the limitations of surgery.

Luetic infection of the ethmoid. This condition presents a mixed hyperplasia. There may be necrosis of the ethmoid cells with extension into the orbital plate. Rarely there is reported a case of gumma of the concha media with extension into the ethmoid.

Mucocele. Occasionally physicians who do eye work see a mucocele of the ethmoid region. This is present in an anatomic variation of the usual ethmoid cell, the cell being much larger and placed laterally. Marked exophthalmos may be present. Sometimes it is difficult to differentiate from a tumor of the orbit.

Atrophic form of ethmoid labyrinth disturbance. Here the changes are usually associated with atrophic processes in the nasal mucous membrane and bony framework. In this the lateral bands of the pharynx are deeply injected. There are thick mucopurulent crusts present in the oropharynx. A condition of pharyngitis sicca, as is also present in chronic sphenoid sinus infection,

is often associated. There are deposits on the vocal structures giving rise to an irritating dryness and hoarseness. Marked ozena is often a sequela. This is an unfortunate complex for the patient, and any promise of relief is gratefully received.

DIAGNOSIS

The diagnosis of the suppurative types of ethmoid infection should present no especial difficulty. The symptoms are clear and the physical findings distinctive. The source of the discharge is located by anterior and posterior rhinoscopy. The nasopharyngoscope can be used to advantage. Skiagraphs are helpful but not essential.

The hyperplastic type is usually easily diagnosed. Here the presence of the polypoid tissue in the region of the middle meati is seen. Postnasal examination by mirror discerns the polypoid degeneration of the posterior ends of the conchae. The lateral bands of the pharynx may be found injected.

Other types of cases in which the physical findings are not especially distinctive are more difficult of diagnosis. It is in these cases that carefully made roentgenograms are of great value. Granger [7] and others have established special technique which often helps one to discover posterior group infection. It is very essential that we should familiarize ourselves with the proper interpretation of the roentgenograms of the area. We should not be compelled to take as final the report of findings alone. Injection of the sinuses with opaque material, such as iodized oil preparations, is of great value in securing a better estimate of the situation.[8]

TREATMENT

The treatment of ethmoid disease presents a problem. The anatomic situation of the ethmoid labyrinth, together with its surrounding structures, makes the surgical intervention difficult. It is necessary to completely remove the foci of infection, but it is even more important not to destroy nasal tissue unnecessarily. Many of the poor results obtained are due to unskilled operative procedures in the nasal passages by those who do not have a proper appreciation of the anatomy and physiology of the region. Atrophic rhinitis, loss of smell, persistent fistula, and even damage to orbital or cranial contents may result because of careless surgical work of the ethmoid region. In rare cases only is it necessary to remove a large portion of the middle turbinal body. In many cases even resection of the concha media is not needed. Where the naris is narrow, simple high submucous resection, together with infraction of the concha media toward the septum will give ample space to exenterate the ethmoid. Cases that have marked deviation of the septum are most likely to have the most ethmoid involvement on the side with the free space. This is because of the marked hyperplastic changes that have taken place in the region. This hyperplasia is secondary to a compensatory hypertrophy which occurs in nature's effort to have the unobstructed side perform the physiologic functions normal to both sides.

Entrance into the ethmoid labyrinth is obtained by opening either the bulla or the agger nasi cell. Exenteration then can be done backward, using a Gruenwald or Knight forceps, care being taken to stay in the midline in both meridians. This will obviate the danger of opening into the orbital plate or superiorly the cribriform plate. The exenteration is carried backward until the rather firm wall of the sphenoid is met. The anterior and lateral group of cells can then be searched out and exenterated by use of Mosher's curet or a small Gruenwald. Anatomical anomalies should be looked for and exenterated, especially the large cell often found just under the frontal. In cases that have retrobulbar symptoms the layer of cells around the inner and posterior rim of the orbit should be looked for. There is little danger of injuring the orbital contents if one is cautious and does not use force in pulling out tissues. There is a rather thick layer of orbital tissue between the eye itself and the ethmoid. Care should be taken not to unhook the tendon of the oblique muscle of the eye while exenterating the superior cells.

*Anesthesia.*—It is essential to success to have perfect anesthesia and hemostasis. Ephedrin added to the anesthetic material used is slower in action than adrenalin, but the effect is more lasting. A combination of both is quite useful. The choice of anesthetic is left to the individual operator. Some are using butyn; some use cocain paste; some, a 2 to a 20 per cent solution of cocain. It is believed that more toxic absorption is obtained from packs of cocain solution than from cocain paste topically applied. One can regulate the amount of paste, but the amount of absorption from packs is an unknown quantity. A preliminary dose of one of the barbital derivatives is useful in preventing shock, it being the physiologic antidote for cocain toxicosis. Nasal packs may be used after operation if severe hemorrhage occurs, none being used otherwise, as it is not believed wise to allow retention of the secretions. In the best interests of patient and physician, patients requiring exenteration should be hospitalized. Here any emergency measure can be easily carried out. The practice of carrying out operative procedures in the office and returning the patient to the home, or even to the street, is undesirable. Contact with the patient is lost and makes possible annoying and troublesome incidents.

Complete exenteration should be carried out in those cases where the indications are present. In the simpler cases, infraction of the concha media with opening into agger nasi and bulla ethmoidalis is all that is needed.

Experience with radium in the hyperplastic types has not been satisfactory. Its use in malignancies is indicated, as is diathermy. Myerson has reported some interesting work along this line.

In the simpler types of acute catarrhal ethmoiditis, careful shrinking of the nasal membranes with a suitable agent gives relief. Weak solutions of cocain with addition of small amounts of ephedrin or adrenalin have given best results. Adrenalin or ephedrin alone have not been so satisfactory, the secondary swelling being greater than the primary after a short interval of time.

Nasal irrigations should, in the acute cases, be looked upon with caution. Many times one sees tubotympanic processes set up by unwise irrigation.

The use of vaccines and general medication does not come within the scope of the specialty. If the patient is in need of general treatment he should be referred to the family physician, together with any suggestion toward treatment. We should be careful not to invade the field of the general man. It is his place, not ours, to administer vaccines, drugs, etc. The use of the various antiseptics in the treatment of ethmoiditis has not been satisfactory. The mild silver preparations do have some astringent effect, but it is not believed that the condition is helped by them.

It is desirable to mention in this connection the treatment of ethmoiditis by the external operation. One sees at times a patient with fulminating pansinusitis where the ethmoids are equally involved with other sinuses. These patients are often extremely ill, with high temperature and evidence of a very severe general sepsis. Delay in operation may result in fatal issue because of the rapidity of the destructive processes. One should not temporize in these cases by minor operative procedures. Complete exposure of the infected areas should be the aim. The external route is the best and quickest method to be undertaken. All bony walls of sinuses involved should be laid open and drainage established. The type of external operation should be chosen that will best accomplish this purpose. Here again supportive measures are of the most importance. The patient should also be under the observation of a competent internist. Transfusion should be done early if indicated. These massive infections seem to be of two types, those caused by staphylococci and those of mixed infection with the streptococci hemolyticus present. The latter patients usually present themselves during influenza epidemics.

Ethmoiditis in children is common.[9] Usually it is of the mild catarrhal type and responds to local measures. In the purulent type free opening of the bulla is usually sufficient. This of necessity must be done under general anesthesia. Any or all of the types and symptoms found in adult life may be present in children. Many cases of tubotympanic disease have ethmoidal infection as a casual factor.[10] Treatment should be prompt and persistent.

## CONCLUSIONS

Ethmoiditis is a frequently encountered condition and may be of grave consequence if untreated.

Careful survey of each patient should be made as to advisability of surgical treatment. Surgery of the posterior sinuses should not be recommended unless definite pathological conditions can be clinically established.

Surgery of the ethmoid region should properly be performed in hospitals.

Most cases of mild infection will readily clear up under proper local treatment.

Collaboration between internist, roentgenologist, family physician, and rhinologist is very desirable.

609 Security Building.

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## DISCUSSION

F. H. Linthicum, M. D. (914 Pacific Mutual Building, Los Angeles).—In a survey of the highly involved subject of infection of the ethmoid labyrinth, Doctor Arnold's excellently presented plea for conservatism in this field of our specialty is timely. We have all realized that present-day sentiment is turning away from the radical procedures which have been in vogue in the past, in favor of the more conservative consideration and treatment of sinus disease in general, and ethmoid infection in particular.

So-called preventive medicine has claimed the attention of workers in many specialties—perhaps as little in ours as in any other. It would seem that an opportunity is offered in this field in the subject under discussion.

All acute sinus infections have a tendency to heal spontaneously. Such infections become chronic in two ways. First, as the result of repeated acute attacks, which bring about changes in the mucous membrane, resulting in destruction of the ciliated epithelium, accompanied by cellular infiltration, or the deposition of scar tissue. Too frequent acute attacks may also bring about occlusion of the secretory ducts, giving rise to hyperplastic formations and the presence of polypi. Second, because of mechanical or obstructive causes. These comprise anatomical anomalies, polypi, enlarged turbinates.

It is probable that the groundwork for much of adult ethmoid disease is laid through the neglect of the so-called simple head colds which occur in childhood and early adult life, or by failure to correct the various intra-nasal or pharyngeal obstructions which play a part in the susceptibility to these colds. It is an axiom that is too often overlooked, that the ventilated nose will usually take care of its own acute infection except in the presence of chronic diseases. The con-

gestion brought about to the mucous membrane of the nose by an acute coryza is one arc of a vicious circle. The swollen mucous membrane occludes the sinus orifices and the ensuing sinusitis will not permit the congested mucous membrane to subside of its own accord. Neglect of repeated insults such as these to the sinus groups eventually results in destruction of or pathologic changes in the lining mucous membranes, which tend to give rise to chronic ethmoid or other sinus disease.

An acute rhinitis cannot be cured overnight by any method, but certainly the nasal passages which are kept ventilated during the course of an acute infection will right themselves much more rapidly than a neglected nose, and the shorter the course of an acute infection the less chance of permanent damage to the ethmoid labyrinth.

Just as important from the standpoint of ethmoid and other sinus disease is the removal of mechanical obstructions to nasal ventilation as early in life as is consistent with safety. These two groups of the more common causes of chronic disease of ethmoid are correctable and to an extent preventable; to correct them means to persuade the specialist to remove mechanical obstructions in the patients whom he sees late in childhood or early in adult life and to educate the parent in the proper way of taking care of an acute coryza and not to say, "The child just has another cold."

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Isaac H. Jones, M. D. (1930 Wilshire Boulevard, Los Angeles).—It seems to me that Doctor Arnold has given a balanced and proper valuation of medical and surgical treatment of ethmoiditis. It is practically impossible to generalize on such a subject. Such a very few years ago there was no ethmoid surgery—or, for that matter, no tonsillectomy or submucous resection of the septum. All are contented with the rather uniformly satisfactory results of operation on the tonsils and the septum. It is such a different matter with the nasal sinuses, particularly the ethmoids. About two decades ago careful anatomic studies of the sinuses caused us all to feel that the sinus problem might be solved. For a long period nasal operations were performed for anatomical reasons only. The leaders in rhinology have all felt in the past few years that much of the radical surgery of the sinuses has disregarded essential physiologic facts. We all see many patients who on the one hand are uncomfortable with pus and crusting, or on the other hand suffering neuralgic pain which is most difficult to relieve. Much sinus surgery is surely necessary and on the whole satisfactory, but this is more true of the maxillary antrum and less of the sphenoid, frontal and ethmoid. The ethmoid constitutes such a honeycomb of cells of such varied size and structure and interrelation, that the establishment of even adequate drainage is difficult without radical exenteration. Recently, in cases of old and extensive involvement of maxillary antra and ethmoids, we removed the ethmoid cells through canine fossa approach. From the anatomic standpoint this is all very well, but one must wait for many months before one can say that the end result is satisfactory. It is very easy for us to say that all necrotic bone and polypoid tissue must be removed, but it is difficult to limit any work on the ethmoids to such pathologic tissue. We are surely unable to avoid also removing a certain appreciable amount of healthy bone and valuable mucosa with its invaluable ciliated epithelium. After any radical operation, one then awaits for the final result with no great assurance of a satisfactory outcome. Personally, if I were afflicted with ethmoiditis, chronic, I would wish prolonged local care before any surgery and then, if unavoidable, a most modified form of surgery; it is always possible to remove more and more, but it is not possible to restore structures that have been removed.

It is intriguing to consider what the bacteriophage will come to mean to us. It will surely meet a definite need, if its action proves to be applicable to subacute or chronic infections of the ethmoids or other sinuses. D'Herelle first noted that a test tube of culture media clouded by bacterial growth would become clear upon the addition of a certain strain of bacteriophage. This spontaneous bacteriolysis has occurred in cultures of various forms of stapylococcus—not in streptococcus. Schultz of Palo Alto has reported such work at this meeting. To be sure, we can never expect that any bacteriophage can restore degenerated tissue. However, if local application to the sinuses can bring about a prompt local bacteriolysis, we do know what a remarkable recovery is possible in tissue, once the bacterial factor is eliminated. It is encouraging, in this connection, to know that the most usual organism in the infected nasal sinus is the staphylococcus.

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Doctor Arnold (Closing).—Doctor Shambaugh would be very gratified, I am sure, if he could be here and listen to the note of conservatism that is predominant. Those who are sponsors of postgraduate instruction in the specialty are teaching that surgery should only be resorted to when other measures have failed, and that when it is performed the nasal tissues should be left in as near a normal condition as possible, so that physiologic functions will not be destroyed.

# POLIOMYELITIS*

## A REVIEW OF THE LITERATURE

*By* Beatrice Howitt, M. A.
*San Francisco*

### EARLY EPIDEMICS

THE first big epidemics of poliomyelitis were reported from the Scandinavian countries, that in Sweden being described by Bergenholtz in 1881. As early as 1840 Heine had first described the paralytic form as a separate disease entity, but it was not until after the second Swedish epidemic in 1887 that Medin recognized the early and preparalytic forms. From this starting point in Sweden, outbreaks were noted in Norway, in Germany, in Austria, and then in the United States in 1907. Another severe epidemic was reported in this country in 1916, principally in the State of New York.

These outbreaks stimulated much research both here and abroad, especially by Flexner and his associates at the Rockefeller Institute and by Landsteiner, Levaditi, Leiner and V. Wiesner in Europe. During this period it was experimentally shown that the disease was due to a filterable virus and that it could be transmitted from monkey to monkey by different routes of inoculation, producing clinical poliomyelitis. It was also demonstrated that the serum of a recovered monkey was capable of neutralizing an infective dose of virus in vitro.

### RECENT EPIDEMICS

After the first output of experimental work on poliomyelitis, interest seemed to wane, until it was again aroused by the occurrence of fresh epidemics throughout the world. This review is therefore dealing largely with the most recent information published during the past five or six years.

According to the 1930 report of the League of Nations,[1] the most important epidemics of polio-

* From the George Williams Hooper Foundation for Medical Research, of the University of California, San Francisco, California.